Water Use Efficiency

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CALFED
BAY-DELTA
PROGRAM

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Memorandum

Date: September 16, 1997

To: CALFED Policy Group

From: Lester A. Snow
Executive Director

Subject: Information Item -- Benefits of Agricultural Efficiency Improvements in Export Areas

At the last meeting of the Policy Group there was some discussion of the Bay-Delta Program's proposed water use efficiency program, and the Policy Group requested a briefing on the draft program. Subsequently, the Management Team requested briefings on all components of the alternatives. It may be more appropriate to brief the Management Team first, and work to resolve any outstanding issues at the Management Team level before briefing the Policy Group. Apart from a briefing on the contents of the draft water use efficiency program, it is essential to achieve a common understanding of the relationship between water conservation in export areas and the effect that conservation may have on Delta diversions. This will be the topic of our agenda item at the Policy Group meeting.

An important concept related to water use efficiency and water transfers is the distinction between *recoverable losses* and *irrecoverable losses*. The term *losses* refers to water that could be conserved; the difference between recoverable and irrecoverable is the destination of that water if it is not conserved, and whether it could be recovered for other uses. This memo provides a simplified overview of the potential benefits of improved water use efficiency, how those benefits can vary case by case, and the effect of efficiency improvements on the level of Delta diversions. The following points are discussed:

- real water savings compared to reductions in recoverable water
- the potential benefits when real water savings occur
- the potential benefits when there is applied water reduction, but no real water savings
- the potential ecosystem benefits even with no reduction in the volume of Delta diversions
- case-by-case variations of who benefits

Real Water Savings versus Reductions in Recoverable Water

In theory, all losses are recoverable. In practice, however, losses that flow to very deep aquifers or excessively degraded water bodies may not be recoverable because of prohibitively expensive energy requirements (i.e., they become irrecoverable). Distinguishing between irrecoverable and recoverable losses is typically based exclusively on water quality considerations.

Principal water bodies that are generally regarded as irrecoverable include saline, perched groundwater underlying irrigated land on the west side and southern end of the San Joaquin Valley, the Salton Sea, which receives drainage from the Coachella and Imperial Valleys, and the ocean.

In parts of the west side of the San Joaquin Valley this water cycle is even more complex. Some lands in this area have subsurface losses that are considered degraded, and hence, irrecoverable, but surface losses that are considered recoverable. Many times these two losses are co-mingled and result in drainage that is discharged into surface waters such as the San Joaquin River. Even though part of the drainage is of undesirable quality, it still becomes a recovered supply available to other downstream interests.

A reduction in irrecoverable losses results in a water supply that can be reallocated to other beneficial uses. This is referred to as a real water savings. Conservation of water in areas where water returns to the hydrologic system in a usable form, however, only reduces recoverable losses, possibly at the expense of other beneficiaries. Recoverable loss reductions can potentially yield ecosystem or water quality benefits but not water supply benefits (i.e., they do not generate a water supply for reallocation).

A reduction in irrecoverable losses in Delta export areas will not necessarily reduce Delta diversions. A water right holder may use the conserved water to irrigate other lands or satisfy growing urban demands.

Potential Benefits of Real Water Savings

There is potential for real water savings in export areas through reduction in irrecoverable losses. Many efficiency measures were implemented by irrigators during and after the most recent period of drought to capture irrecoverable losses. When such real water savings do occur, the resulting amount of water conserved becomes available for reallocation to another water supply purpose. For agricultural export areas, the reallocation could be to a variety of destinations and purposes, including:

- agricultural, urban, or environmental uses in export areas, such as providing water to currently under-irrigated lands, recharging overdrafted groundwater sources, supplying wildlife refuges, or meeting urban needs;
- agricultural or urban uses upstream of the Delta diversion; and

- environmental uses upstream of the Delta diversion, including refuges, instream flow, and Delta outflow.

If reallocation is made within export areas, there will be no accompanying reduction in Delta diversions. If reallocation is made to an upstream area, then there would be an accompanying reduction in the amount of water exported from the Delta.

Any reallocation of real water savings to other water supply uses would constitute a benefit to water supply reliability. These reallocations may also create other, non-water supply related benefits, as described below.

Potential Benefits of Applied Water Reduction when Losses are Recoverable

When recoverable losses are reduced through efficiency improvements, the water applied to crops can also be reduced. Although this reduction does not produce a water supply for reallocation, it can generate several other benefits. However, a reduction in applied water can have negative impacts as well. A reduction in existing recoverable losses in the San Joaquin Valley may have negative impacts on:

- surface or groundwater supplies for downstream users;
- incidental wildlife habitat in drains and in adjacent wetlands;
- incidental supplies to managed wildlife refuges;
- contribution to dilution for other drainage inflow (though some recoverable losses create their own adverse water quality impacts); or
- instream flows for riparian and aquatic ecosystems.

A reduction in applied water will usually not result in reduced Delta diversions because of the potential impacts on other water users.

Potential Ecosystem Benefits Even with No Reduction in Delta Diversions

Even if there is no reduction in Delta diversion accompanying improved agricultural efficiency in the export regions of the Central Valley, there can be several other significant ecosystem benefits. These include:

- Change in timing of Delta diversions. If a transfer from an agricultural water user to an urban user in the export areas occurred as a result of reducing irrecoverable losses, there could be an opportunity to vary the timing of the diversion. What originally was diverted for direct use by agriculture may instead be diverted at a time when there is less ecosystem impact because of a change in the time of use. This could require the integrated use of storage reservoirs in export areas.

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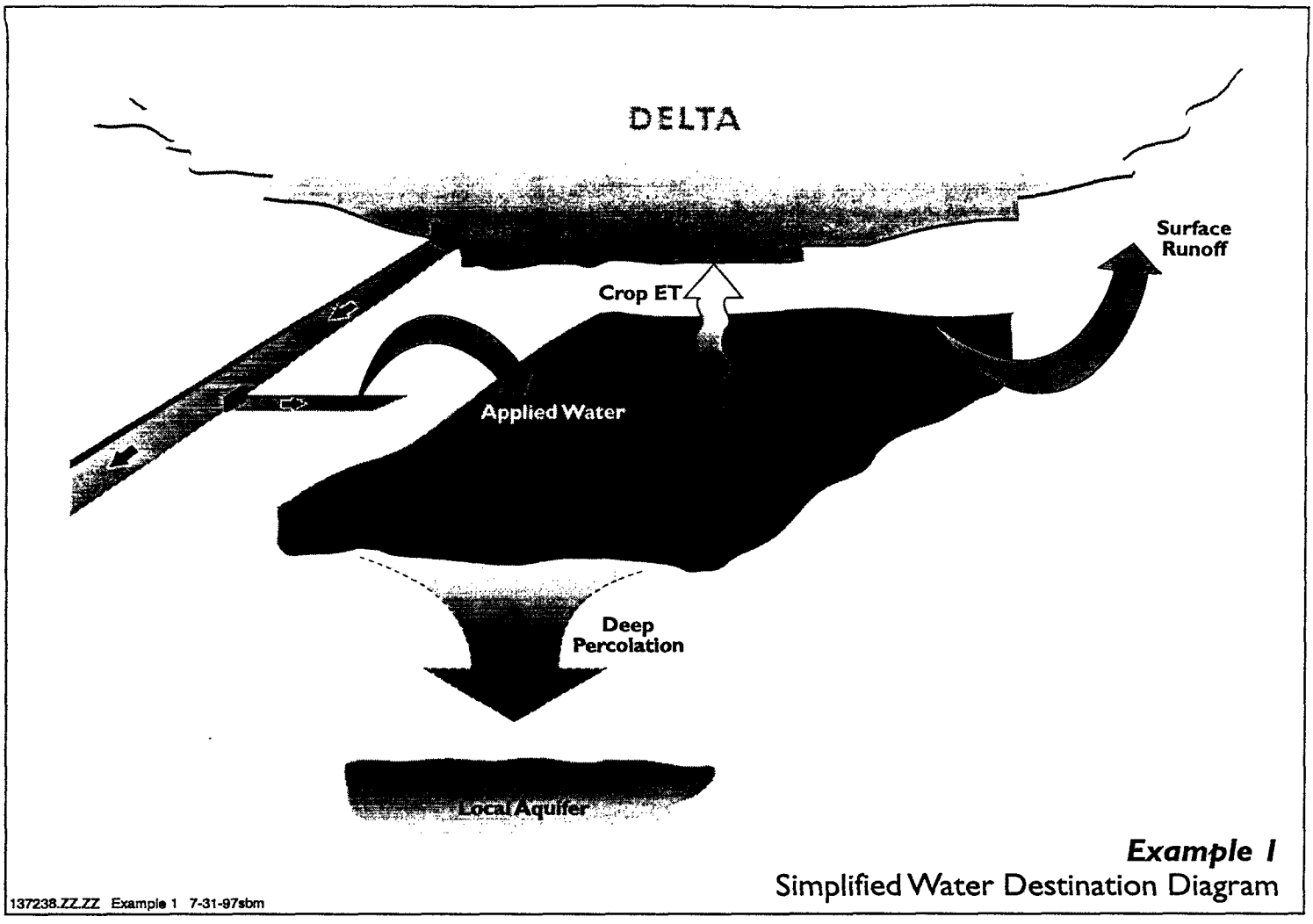
- Change in timing of reservoir releases. This would relate directly to the ability to change the timing of the diversion. Modified timing of reservoir releases could yield benefits related to instream flow, stage, and possibly temperature. There could also be additional benefits to reservoir recreation.
- Improved water quality in the San Joaquin River and adjacent streams and sloughs. Potential gains in water quality could result if reduced applied water was directly discharged to surface waters to aid in dilution.

Case-by-Case Variations in Benefits

Each efficiency measure that is implemented will yield its own unique opportunities to generate multiple benefits. In some instances, reductions in the amount of water diverted from the Delta can occur. In others, downstream users depend on recoverable losses for their supply. Potential benefits of efficiency improvements need to be determined on a case-by-case basis.

Another factor that may affect the type of benefits generated by efficiency improvements is any incentive program or negotiated contract that results in the implementation of efficiency measures. For example, there have been many recent transactions in which one water user contracted with another user to transfer conserved water. Variations in the motivation and funding for efficiency improvements will affect the type and extent of benefits that may occur. Incidental benefits, not necessarily defined in contracts or incentive programs, will also vary with each action undertaken. These could include water quality improvements if surface runoff is reduced, reduced diversion impacts if applied water is reduced, or possibly improved instream habitat conditions if cleaner water is made available to surface streams.

The three examples below illustrate different conditions encountered in the San Joaquin Valley and the conservation opportunities they offer.



Example 1
Simplified Water Destination Diagram

Water is diverted from the Delta, routed through a delivery canal and applied to the land. In this example, the lands are located in close proximity to the Delta; groundwater and surface sloughs are predominantly influenced by the Delta. Water applied to the land results in:

- Crop consumption (evapotranspiration or ET)
- Deep percolation to a local, usable aquifer
- Surface runoff to Delta-influenced surface waters

When on-farm efficiency is improved:

- There is no change in crop consumption
- No real water savings are gained since current losses flow to other usable bodies of water (i.e., they are recoverable)
- Delta diversions could be reduced up to the amount of applied water savings, potentially yielding benefits such as reduced fish entrainment and reduced pumping costs

(This example is fairly similar to conditions in the Sacramento Valley, where conservation measures may reduce diversion impacts but typically do not yield real water savings.)

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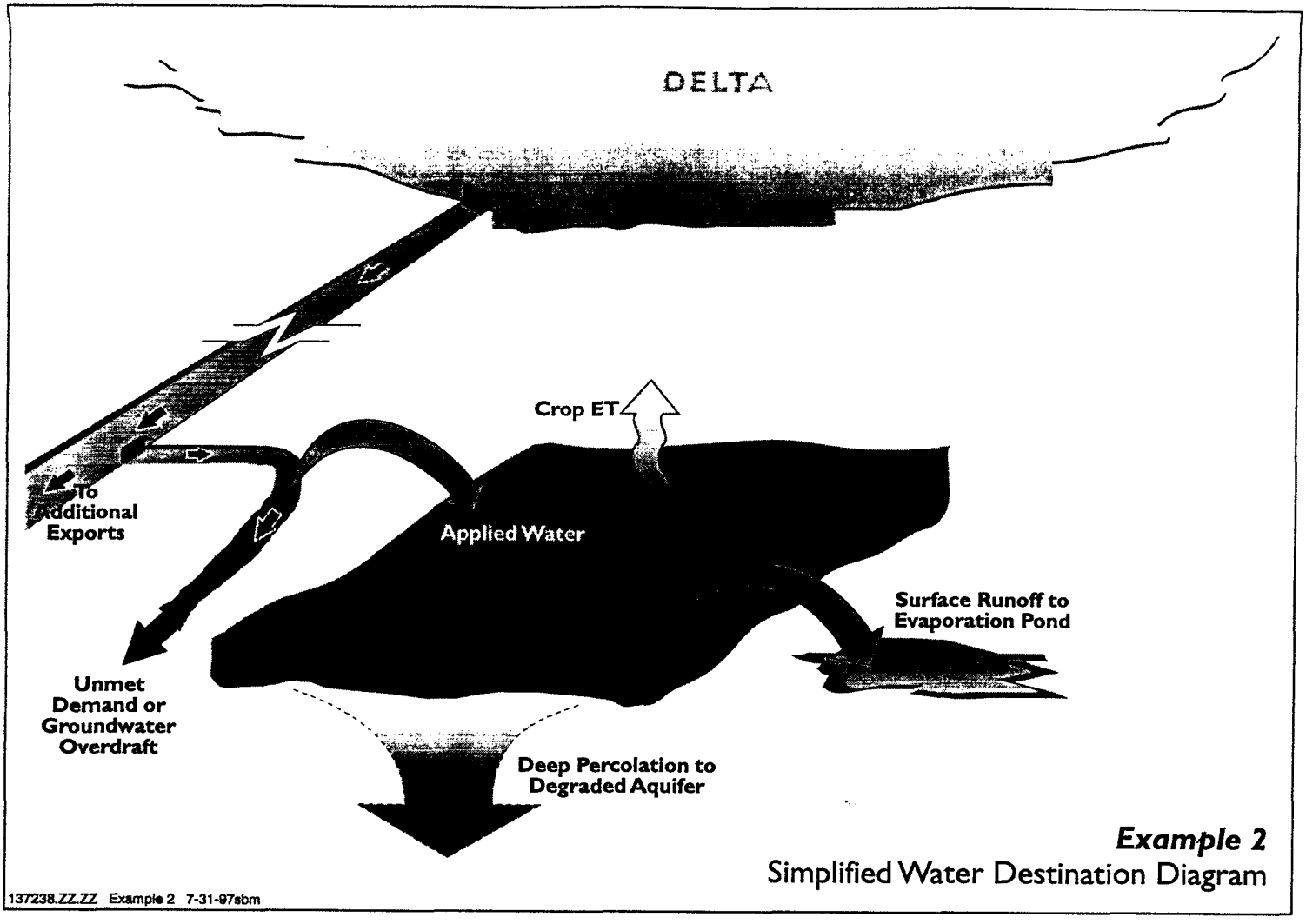


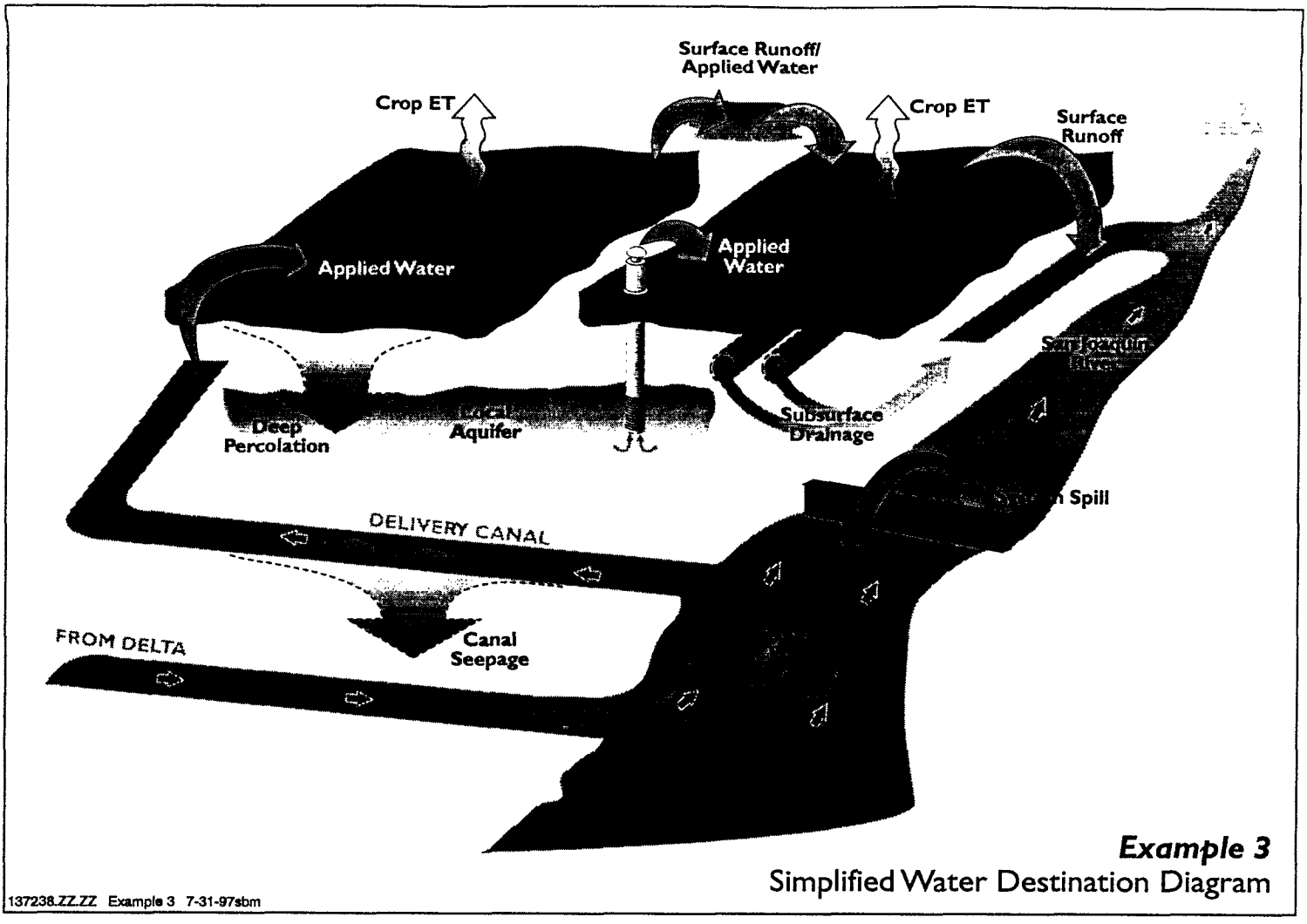
Example 2
Simplified Water Destination Diagram

Water is diverted from the Delta and routed far to the south, where it is diverted through a delivery canal and applied to the land. In this example, the lands are located in an area where losses associated with irrigation are considered irrecoverable. Water applied to the land results in:

- crop consumption (ET)
- Deep percolation to a local, degraded aquifer or other subsurface sink
- Surface runoff to evaporation ponds or other salt sinks

When on-farm efficiency is improved:

- There is no change in crop consumption
- Real water savings are gained since current losses flow to salt sinks (i.e., they are irrecoverable)
- Additional benefits will vary depending on how the conserved water is used. Either:
  a. Delta diversions could be reduced if irrecoverable losses are transferred to interests upstream of original point of Delta diversion, or
  b. Delta diversions remain the same if irrecoverable losses are transferred for other export area interests, including: offsetting of groundwater overdraft, unmet agricultural demands, urban needs, or refuge water supplies



Water is diverted from the Delta and delivered to the Mendota Pool on the San Joaquin River. From this point it flows through a delivery canal and is applied to the land. In this example, the lands are located in an area where losses associated with irrigation are considered recoverable. Water applied to the land results in:

- Crop consumption (ET)
- Deep percolation to a local usable aquifer which becomes a source for other users; and a subsurface drainage system which is discharged into a nearby surface stream
- Surface runoff to a local drain used as a surface supply source by a downstream user; and a nearby surface stream tributary to the San Joaquin River

When on-farm efficiency is improved:

- There is no change in crop consumption
- No real water savings are gained since current losses flow to some other usable source (i.e., they are recoverable)
- Either:

a. Delta diversions could be reduced up to the amount of the reduction if the reduction in recoverable losses does not result in adverse impacts to existing beneficiaries of those losses, or such impacts are properly mitigated, or more likely

b. Delta diversions remain the same if the reduction in recoverable losses continues to be delivered to meet existing downstream benefits but also now provide additional benefits such as improved water quality